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AUTHOR Rubino, Antonio N.; And Others
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ABSTRACT

Science kit is a tool used to teach science in several schools. Science kit inservices are intended to provide teachers with the skills needed for using science kits. The evaluation of science kit/inservice workshops to assess their effectiveness to enhance teachers' science knowledge, positive attitude toward science, and science teaching is an important aspect of science education. This paper shows how science kit/inservices have affected elementary teachers' science knowledge, attitudes toward science, and science teaching practices in several schools in Southwest Michigan. The subjects of this study were 397 teachers who participated in science kit workshops. A questionnaire was mailed to participating teachers asking them to report on the effects of the program on themselves. Fifty-four percent (214) of the teachers returned the survey. Findings indicate that science kit/inservice workshops and kit use in the classroom have increased teachers' science knowledge, positive attitude toward science, and science teaching skills. (Author)

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Science and Mathematics Program Improvement

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Effects of Science Kit/Inservice and Kit Use on Teachers' Science Knowledge, Attitudes, and Teaching

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Antonio N. Rubino

Zoe A. Barley, Ph.D.

Mark Jenness, Ed.D.

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Abstract

Science kit is a tool used to teach science in several schools. Science kit inservices are intended to provide teachers with the skills needed for using science kits. The evaluation of science kit/inservice workshops to assess their effectiveness to enhance teachers' science knowledge, positive attitude toward science, and science teaching is an important aspect of science education. This paper shows how science kit/inservices have affected elementary teachers' science knowledge, attitudes toward science, and science teaching practices in several schools in Southwest Michigan. The subjects of this study were 397 teachers who participated in science kit inservice workshops. A questionnaire was mailed to participating teachers asking them to report on the effects of the program on themselves. Fifty four percent (214) of the teachers returned the survey.

Findings indicate that science kit/inservice workshops and kit use in the classroom have increased teachers' science knowledge, positive attitude toward science, and science teaching skills.

Effects of Science Kit/Inservice and Kit Use on Teachers' Science Knowledge, Attitudes, and Teaching

Improvement of science teaching and learning are needs of the educational system in the United States. Low scores in math and science tests of American students when compared to students from other countries has motivated the interest in the development of science literacy among teachers and students, and the need for increasing student achievement in math and science (Shaw, 1993). Thus, the fourth educational goal formulated by ex-president George Bush, in "America 2000", establishes: "By the year 2000, U.S. students will be first in the world in science and mathematics achievement... Math and science education will be strengthened throughout the system, especially in the early grades" (Bush, 1991; p. 63).

Improving teacher scientific literacy is a task that requires the involvement of all public and private entities that may collaborate financially and academically. In Michigan, the W. K. Kellogg Foundation has become involved, through the Kellogg Science Education Initiative, in the support of different strategies and innovations to increase the excellence of science education in the State (Barley, Jenness, Pearl & Rubino, 1991). Kellogg Foundation has awarded funds to

educational agencies to promote scientific literacy in Michigan. Individual project programming is diverse, including workshops for inservice teachers, summer science research projects for students and teachers, curriculum development, science and computer labs, model classroom, and science equipment distribution, among others (Barley, Jenness, Pearl & Rubino, 1991)

One of the strategies used actually in several schools, supported by Kellogg Science Initiative, is science kits to teach science. The projects funded by Kellogg Foundation have organized kits around specific themes for each grade level, selected after reviewing the existing curriculum, based on Michigan state science objectives; around topics with specific activities in each topical area for several grade levels; and around the existing science curriculum by grade level and science thematic areas. Kits were developed by project staff and teachers who drew materials from local and national science projects. The kits used by teachers and students in this study include booklets with appropriate science background material, activity instructions, objectives/outcomes, materials/supplies and equipment. These kits were used by teachers who were inserviced in kit uses (Barley, Jenness & Rubino, 1992).

Kit/inservices were 5 to 6 hours long. They included hands-on activities

in which teachers learned how to use kit booklets, materials/supplies and science equipment. Teachers completed workshop activities under the guidance of a teacher- trainer.

There were not found studies on effects of science kit workshops on teachers. However, it is known that other types of science inservice workshops have a positive effect on attitudes of elementary teachers (Bethel and Hord; 1982; Bitner, 1986; Clark, 1972; DeGroote, 1972; Enz, Horak & Blecha, 1982; Hall, 1990; Zielinski and Smith, 1990). Teachers who have attended science inservices indicated positive feelings toward science, and differences in science attitude before and after the inservice (Bethel and Hord; 1982; DeGroote, 1972; Hall, 1990). Their scores in the Science Attitude Scale showed a high proclivity, stable over time, to do science (Zielinski and Smith, 1990); and they showed reduced apprehension toward using science equipment (Bitner, 1990).

Science inservice workshops also have positive effects on teacher science knowledge. Teachers who have attended to science workshop demonstrated increased knowledge about science (Bethel and Hord, 1982; Enz and others, 1982). Riley (1975) also found that science process training on preservice teachers increased teachers' process skills abilities. In addition, Zielinski and Smith (1990)

reported that those teachers who participated in science seminars, demonstrated significant gains in knowledge of science measured through the science knowledge and comprehension test.

Attendance at science workshops and time spent teaching science have been found to be related. Teachers who attended to science workshops spend more time teaching science (Dawes, 1987, Kyle, Bonnstetter, McCloskey & Fults, 1985). In addition, teachers who attend to science workshops have different approaches toward science instruction (Barman, Barman & Shedd, 1989). Changes in teaching science were established by Bitner (1990) who found that teachers who were in science inservices, are more confident using science equipment, doing lab work, and discussing science topics.

On the other hand, some studies show different results. Riley (1975) found that science process training did not increase understanding of science and there was no change in overall attitude toward science for preservice teachers. Clark (1972) found that there was no relationship between college teachers' knowledge of science and their attitude toward science. These results are similar to the ones found by Shrigley (1973) with preservice elementary teachers. Although these studies contradict the previously cited findings, it is important to point out that in

this study the population is elementary school teachers. Riley, Clark, and Shrigley studied populations different from elementary school teachers.

The purpose of this study was to determine if kit/inservice and kit use in the classroom would increase teachers' science understanding, positive attitude toward science, time spent teaching science, and time doing science activities in the classroom.

Methods and Procedures

Subjects

The subjects of this study were 397 teachers, whose names were supplied by the three different educational agencies that participated in the survey. One of the agencies was located in an inner-city area, and the other two in mid size cities. Teachers were involved in science kit/inservice workshop activities and in the use of the kits in the classroom. Of the 397 teachers surveyed, 214 returned the survey (54% return).

Instrument

A three-page questionnaire was mailed to participating teachers in late Spring 1992. Part of it concentrated on the effects of science kit/inservice workshops and kit use on teachers. The survey asked teachers to report the effects

of the program on themselves. Teachers were asked for other science activities besides the use of kits. Only the section of the survey related to effects of science kit workshops on teachers is reported in this study.

Results

Overall, more than 69 percent of the teachers reported changes in their science knowledge as a result of participating in the science kit/inservice workshops and using the kits in their classrooms (see Table 1).

Table 1. Effects of Inservice Workshops and Kit Use on Teacher Knowledge of Science

As a result of your participation has your...	YES (%)	NO (%)	N/A (%)
science content knowledge increased?	74	14	12
science process skills increased?	74	12	14
application of science concepts to real world contexts increased?	69	16	15
science teaching methods and techniques increased?	75	10	15

N/A: not answered.

Approximately three-fourths of the teachers reported increased knowledge in key areas for improvement of science teaching such as science content knowledge, science process skills, and science teaching methods. Twelve to sixteen percent of the teachers did not experience improvement.

Teachers were also asked if their attitude toward science and science teaching had been enhanced. Ninety-six percent reported enhanced attitude toward science and science teaching as a direct result of the workshops and use of kits for science activities.

In relation to science teaching, 66 percent of the teachers, said that they spend more time on science because of the kit activities (see Table 2).

Table 2. Effects of Kit Use on Time Spent in Teaching Science

	YES (%)	NO (%)	N/A (%)
Has the use of kits increased the amount of time spent on science?	66	20	14

To quantify this change, teachers were asked to report the time spent on science activities before and after implementing the use of kits in their classrooms. There was an increase of 38 minutes in the average time (min/week) spent on science activities. Table 3 shows the variations in time spent in science activities.

Table 3. Minutes Per Week Spent on Science Before/After Using Kits.

	Mean	Median	Range
Min/week before using kits	98	90	000-600
Min/week after using kits	136	120	030-570
Increase in min/week spent on science	38	30	-

In addition, teachers reported an increase of 37 minutes per week in the average time spent on hands-on science activities because of the use of kits (see Table 4).

Table 4. Minutes Per Week Spent on Hands-on Science Before/After Using Kits.

	Mean	Median	Range
Min/week in hands-on activities before using kits	36	30	000-100
Min/week in hands-on activities after using kits	73	75	010-090
Increase in average min/week on hands-on science activities	37	45	-

These findings reflect important steps in the reform of science education. As teachers gain confidence and knowledge and increase the time spent on science, especially on hands-on activities, scientific literacy is likely to increase.

On the other hand, since kit use is a fairly new experience for the majority of the teachers, the above-reported results have even more importance and promise for continued improvement for teachers and their teaching.

Teachers also responded that they are doing other science activities besides using the kits. Ninety one percent of them said they did additional science activities other than those provided by kits. Most teachers (52 percent) said they have included other topics, classroom activities, trips and outdoor experiences, and experiments besides the kits. They have also tried to relate science to other curriculum areas. Some illustrative comments of this situation are:

> *I do dozens of other things, field trips, human body study, simple machines, etc.*
>
> *I have branched off from kits and we cover other units in our curriculum.*
>
> *We did a unit on under the sea and incorporated information from the water [kit]; most of our thematic units have a science focus.*

Teachers reported other science activities such as building models, doing simple experiments with objects brought by the students, and doing activities designed by themselves.

Conclusion

Teachers who responded to the survey were strongly positive about the effects of science kit/inservice system on their science knowledge, positive attitude toward science, science teaching time, and science teaching strategies. Teachers in this survey were expected and required to participate, rather than having a natural interest or excitement about science, so these findings gain more significance. Teachers believe their own abilities to teach science have been enhanced. They believe that they have increased knowledge of science content, science process skills, application of science concepts to real world contexts, and science teaching methods and techniques. These beliefs are demonstrated through the increased time spent teaching science and the increased use of hands-on activities in the classroom. Teacher comments showed that they are doing different types of activities to increase students understanding of science. This is an additional evidence of the teachers positive attitude toward science. They are not using only the kits but they are trying other ways to teach science. This report provides only excerpts from a large number of teacher responses suggesting that the important initiatives toward teaching scientific literacy have begun in the schools reached by the Kellogg projects. Follow-up surveys are planned to track the progress of these teachers.

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